

What is claimed is:

1. A starter for an internal combustion engine that receives electric power from a battery, comprising:
  - 5 a pinion meshing with a ring gear of an internal combustion engine, and
    - a motor section including a yoke and an armature for driving said pinion via a speed-reduction mechanism, wherein
      - 10 an internal resistance  $r_M$  of said motor section and an internal resistance  $r_B$  of said battery satisfy a relationship that a resistance ratio  $r_M/r_B$  is equal to or less than 0.4,
      - an axial length  $L$  of a coil constituting said armature and an outer diameter  $D$  of said armature satisfy a relationship that a ratio  $L/D$  is equal to or less than 1.0, and
    - 15 a temperature-rise suppressing means for preventing temperature rise in said starter is provided.
  2. The starter for an internal combustion engine in accordance with claim 1, wherein said temperature-rise suppressing means is an excessive current suppressing device provided in an electric power circuit interposing between said battery and said starter.
    - 20
    - 25
  3. The starter for an internal combustion engine in accordance with claim 2, wherein said excessive current suppressing device is a soft soldering portion provided in said electric power circuit of said starter.
  4. The starter for an internal combustion engine in accordance with claim 1, wherein said temperature-rise suppressing means includes a control unit that stops electric power supply from said battery to said starter in response to a signal indicating startup of said internal combustion engine,
    - 30

thereby suppressing the temperature rise in the starter.

5. The starter for an internal combustion engine in accordance with claim 1, wherein said temperature-rise suppressing means includes a cooling device that supplies cooling air to said starter.

6. The starter for an internal combustion engine in accordance with claim 5, wherein said cooling device causes said armature to rotate as a fan for producing said cooling air.

10

7. The starter for an internal combustion engine in accordance with claim 6, wherein the coil constituting said armature has a side surface constituting a commutator and an undercut portion of said commutator acts as said fan for producing said cooling air.

15

8. A starter for an internal combustion engine that receives electric power from a battery, comprising:

a pinion meshing with a ring gear of an internal combustion engine,  
a motor section including a yoke and an armature for driving said  
pinion via a speed-reduction mechanism,

a stationary contact positioned at one end of a terminal provided in said starter and connected to a battery cable for supplying electric power from said battery to said starter, and

a movable contact directly connected to a pigtail of a brush of said motor section and cooperative with said stationary contact to constitute a switch, wherein

an internal resistance  $r_M$  of said motor section and an internal resistance  $r_B$  of said battery satisfy a relationship that a resistance ratio  $r_M/r_B$  is equal to or less than 0.4,

30 an axial length L of a coil constituting said armature and an outer

diameter D of said armature satisfy a relationship that a ratio L/D is equal to or less than 1.0, and

a means for suppressing temperature rise in said starter is provided.

5           9. The starter for an internal combustion engine in accordance with claim 8, wherein said movable contact and said pigtail are fixed by a soft solder.

10          10. A permanent magnet field type starter for an internal combustion engine that receives electric power from a battery, comprising:

              a pinion meshing with a ring gear of an internal combustion engine, and

              a motor section including a yoke and an armature for driving said pinion via a speed-reduction mechanism, wherein

15          when  $r_B$  represents an internal resistance of said battery,  $r_T$  represents an overall brush resistance including a contact resistance to a brush and a commutator, and  $r_A$  represents an armature resistance,

              the internal resistance  $r_B$  of said battery and the internal resistance  $r_M$  ( $r_M = r_T + r_A$ ) of said motor section satisfy a relationship that a resistance ratio  $r_M/r_B$  is equal to or less than 0.4,

              an axial length L of a coil constituting said armature and an outer diameter D of said armature satisfy a relationship that a ratio L/D is equal to or less than 1.0, and

25          said overall brush resistance  $r_T$  is smaller than said armature resistance  $r_A$ , and said overall brush resistance  $r_T$  is equal to or less than 1.5 m $\Omega$ .

30          11. The starter for an internal combustion engine in accordance with claim 10, wherein said brush is a metal graphite brush containing copper by 80% or more.